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Biography

MAJOR-GENERAL J. J. B. TAPLEY, D.S.O., R.A.V.C.

THOSE who knew John J. B. Tapley in College-student days marked him down as one of those who would be heard of again; and that this surmise was correct is shown by the fact that he has now attained the height of every Army veterinary officer's ambition, *viz.*, the position of Director-General of the Royal Army Veterinary Corps. Entering as a student of the London College in 1895, and graduating in 1899, Major-General Tapley had a very steady and uniformly successful career, being gazetted to the R.A.V.C. in 1901. His service includes South Africa, Egypt, the Sudan, France and Belgium, and India.

For services in the South African War he was awarded the Queen's Medal and Four Clasps, being mentioned in despatches. For services in Egypt and the Sudan, Colonel Tapley was decorated with the Order of the Nile, the Sudan Medal and Clasp (Darfur); and during the Great War the 1914 Star and Clasp, the British War Medal, the Victory Medal and three mentions in despatches, a Brevet-Colonelcy, and the Membership of the Distinguished Service Order.

His ability to command was recognised at the War Office by his appointment as Principal Veterinary Officer of the Egyptian Army and Director of the Veterinary Department of the Sudan Government; in the latter of which, in particular, he did sterling work for the cattle trade and the eradication of animal diseases. Now, having attained the highest possible pinnacle in his own department, the profession knows that his work will continue to bear good fruit, and the body of men over whom he rules can rest assured that they will always receive a patient hearing and " a square deal."

XUM

Editorial

A SPECIAL CANINE NUMBER IN JANUARY.

In continuation of our plan of producing specialised issues of The Veterinary Journal from time to time, it is our intention to devote the January number to articles dealing with small animal practice, especially those which are of up-to-date interest to the modern canine surgeon.

The cult of the dog has increased so enormously during the past twenty years that the varied treatments of the diseases and accidental ailments of canine patients now take up the time which used, in town practices, to be given to the horse. Even in the country there is no practitioner who can afford to ignore the fact that if he will give consideration to the requests of the owners of dogs in his district for help when their pets are ill, his day book and ledger will contain, at the end of the year, a very perceptibly lengthened list of clients.

The special numbers which have appeared during the past few years have been much appreciated, and it is because of the added importance of the subject of the medicine and surgery of the dog that we propose to make a still further addition to the number. There will also be an added attraction in the shape of a Supplement, which we propose to make the first of a series, containing, amongst other things, an illustrated article on the history and evolution of the greyhound, by Major-General Lord Loch, C.B., C.M.G., D.S.O., M.V.O., the Vice-President of the Greyhound Racing Association. We must not forget that it is more essential than ever that the Veterinary Surgeon of to-day shall be a well read man, and have as thorough a knowledge about his patients in health as in disease.

SLAUGHTER OF ANIMALS ACT, 1933.

At last, after numerous attempts, Colonel Moore, M.P., has managed to get Parliament to pass the Slaughter of Animals Act, 1933, and this comes into force on the first of January next.

On some later pages we have published the Act in full, and it will be noticed with astonishment and regret by the members of the veterinary profession that (let us hope quite inadvertently) no mention whatever is made of the veterinary officer of health—or even of the veterinary surgeon. The Parliamentary Committee of the Council of the R.C.V.S. has indeed been caught napping this time, for the only officials specified are the Medical Officer of Health and the Sanitary Inspector. *Is it not curious that the one man who, by his scientific training, knows more about the ante-mortem and post-mortem examination of the food animals—viz., the qualified veterinary surgeon—is never even mentioned throughout the clauses of a humane Slaughter of Animals Act?*

XUM

Truly we English are a curious anomaly in our methods! We build veterinary training schools, and establish courses of study for a minimum of five years, which include the diseases of meat, as well as those of the animal from which that edible meat is obtained; and then allow the final and authoritative opinions on each to be given by a doctor of human diseases and a sanitary inspector!!! It would be laughable were it not serious, and the idea even of such an anomalous state of affairs would not be tolerated for one moment in any Continental country, in America, or even in our own colonies. The latter are far ahead of us in this respect, and it is to be hoped that the numerous appointments which are now being made all over the country of County Veterinary Officers of Health will eventually result in our own awakening to the value of our own importance as well as the awakening of the British public to the value of veterinary science, and to the fact that England cannot afford to lag behind in regard to the establishment of public abattoirs controlled and staffed by skilled veterinary officials.

The 1933 Act has allowed Local Authorities to exercise a right of option in so far as the sheep is concerned, *and the efforts of humanitarians must not relax until the sheep has the same blessing of unconsciousness to pain, before the knife is used on its throat, as the pig and the calf.* In expressing this sentiment we are sure that we are echoing the voice of the whole profession when we say that it should be so. Holland has had the law in use for years, and if the Dutch butchers can kill their sheep humanely, surely we can do this too.

XUM

General Articles

THE ERADICATION OF CONTAGIOUS ABORTION: A Northumbrian Experiment.*

By W. LYLE STEWART, M.R.C.V.S., and C. H. WESTWATER, M.A., B.Sc.

Armstrong College, Newcastle-upon-Tyne.

In the period since the War several new facts concerning bovine contagious abortion and its causative micro-organism—*Br. abortus*—have been brought to light. Of these the hitherto unsuspected public health aspect of the problem is of major importance, it being no longer doubted that *Br. abortus* of bovine origin may occasionally be the cause of a serious undulating and prolonged fever in the human subject. That such cases should occur only occasionally has not served to diminish the importance of this discovery, which has stimulated scientific interest and focussed the attention of the medical and veterinary professions in all parts of the civilised world. Under the circumstances it is not surprising that in the flood of new literature which has arisen around the subject, the present methods of dealing with the disease in cattle should have been examined critically and considerable discussion centred around the practice of vaccinating animals with the living causative agent of the disease. In this paper we do not intend to deal with the subject of vaccination, but one noticeable result of the above discussions has been a definite orientation of professional views regarding the control of abortion disease, and the birth of a keener desire to investigate alternative methods. The true significance of abortion in a commercial herd is seldom fully appreciated by farmers at the outset. Falls in milk yields and loss of calves are but two of the more obvious losses. The following figures were obtained from milk recorded herds in which the disease existed:

Table I.—Showing how Lactation Yields may be Depressed through Abortion.

	Gallons of Milk.				
Cow	1926–27	1927–28	1928–29	1929–30	1930–31
1	1401	1500	1122	A_8 832	1007
2	1063	1062	A_7 870	977	Died
3	1028	947	A 748	940	1233
4	752	A_6 263	—	—	—
5	560	536	A_7 291	—	—
6	1030	A_7 561	1070	—	—
7	850	A 714	862	—	—
8	730	1050	896	A_8 324	912

A = Aborted; small figure indicates months. Lactations per milk recorded year.

* Received December 7th, 1932.—Ed., V. J.

XUM

Normal practice in the herds from which these figures were obtained aims at lactation periods of forty-two weeks, followed by a dry or resting period of about ten weeks prior to calving, and the commencement of a new lactation. Consequently the occurrence of abortion always interferes with the resting period. Further, when it occurs earlier in gestation than the sixth or seventh month it will obviously depress the milk yield in two lactations.

Frequently, however, the disease smoulders in a herd, involving less direct losses, which may continue to operate for years, and considerably reduce the productivity and value of the herd. Thus, shy breeding of the females is a frequent sequel to abortion, due to the continued catarrhal condition of the mucous membrane of the uterus. As long as this persists it is most unfavourable to conception, and temporary sterility or nymphomania may result. The breeding efficiency, therefore, is seriously affected, and where these sequelæ occur they constantly interrupt and complicate the management of the dairy. Another point must be considered : when *Br. abortus* settles in the mammary gland a permanent infection is the most likely result, although there may be no outward sign that such animals are otherwise than perfectly healthy. But are they ? At parturition we know they are potential sources of infection, but does the fact that they are chronically infected with the micro-organisms of a serious bovine disease place a discount on their future health and usefulness ? There are veterinarians who believe that it does, and that the general level of resistance to other bovine diseases in such cows is less than that of animals in an abortion-free herd. We have already pointed out how the resting period may be shortened or abolished, thus increasing the physiological strain of the subsequent lactation.

We are willing to admit that the chief objections to the use of living organisms, hitherto employed in the treatment of contagious abortion, seem to be based more on theoretical grounds and the laws of probability than on an indictment of ascertained fact. Until it can be proved that such vaccination does cause any of the disabilities associated with a permanent udder infection, the process will doubtless retain a prominent place in the veterinarian's armoury for combating loss from the disease. At the same time accurate statistical evidence of the positive value of vaccination is still lacking, and it is obvious that the alternative policy of eradicating the disease is more fundamental and progressive, implying as it does a standard of herd hygiene which we not only believe is compatible with good management, but which we think should be obligatory on all milk producers. Further, it is our experience that many farmers do not appear to know that there is an alternative to vaccination, which latter is too frequently resorted to only after abortion has become widespread in the herd.

Since 1930 the writers have had an opportunity of supervising the eradication of contagious abortion from two herds in the North of England. In what follows an account of procedure and results will be given for one herd (later it is hoped to report on the other herd), together with some details with regard to the cost. It may be stated at the outset that procedure and also cost will vary according to

XUM

circumstances, but at present information on these points is meagre, and in consequence may be of interest to others.

The Herd.

A self-contained tubercle-free herd of about sixty animals. The owner stated that contagious abortion had been prevalent for twenty years, and that the breeding and general health of the animals since had been indifferent. His veterinary surgeon was of opinion that sterility, nymphomania, granular vaginitis, mastitis, etc., all of which were troublesome, must in part at least be attributed to a low level of breeding and general health consequent upon the presence of contagious abortion. As the owner was producing certified milk he desired the healthiest cows. In July, 1930, the dairy herd consisted of the following: 20 cows, 15 in-calf heifers, 25 younger females clear of bull, 1 bull.

A preliminary blood test of the dairy cows at this time showed the presence of six reactors, and in addition three cows gave doubtful reactions. The other stock was not tested. After consultation, a detailed scheme was devised for eradication, which came into operation in October, 1930. The essentials of the scheme were: (1) All animals in the herd over the age of twelve months to be blood tested monthly until there were no reactors. (2) All reactors to be segregated immediately and sold at the earliest opportunity. (3) All animals showing a doubtful reaction to the blood test also to be held in isolation pending knowledge of their true status. (4) All necessary herd replacements to be purchased subject to the agglutination test carried out on the vendor's premises. After delivery such cows to be placed in isolation for one month, retested, and admitted to the clean unit only if the second test proved negative. (5) The institution of "maternity" stalls or boxes for all calving or aborting cows. (6) The cleansing and disinfection of buildings. (7) The double fencing of cow pastures by means of a strand of barbed wire placed four feet from the hedges.

Provided no further abortions occurred at grass, we considered that the pastures would be safe for the healthy unit the following May. All the manure from reacting animals was earmarked for arable land, orchards and gardens. In practice the farmer removed all reactors immediately to a neighbouring farm, whence they were sold either fat or as replacements in herds known to be infected. No animal was sold to another herd without disclosing her true history. Doubtful reactors were isolated on the premises, and precautions taken to prevent contact with the clean herd either directly or through the agency of attendants or milkers.

Technique of the Agglutination Tests.

These tests were carried out after the method of McFadyean and Stockman, using a polyvalent antigen composed of five different strains of *Br. abortus*, killed with minimum heat and suspended in 0.9 per cent. saline to a convenient density. The opacity of the antigen chosen to carry out such tests does not seem to matter so long as it is kept well below the point of non-specific sedimenta-

XUM

tion. All tubes were placed in a water bath running at 54° C. for six hours. A positive reaction can thus be detected much earlier than by incubation at 37° C. Sedimentation is usually complete in five hours, but as delayed reactions occasionally occur it is best to defer the final reading until the tubes have stood overnight at laboratory temperature.

The dilutions of serum and antigen in routine use were 1 : 20, 1 : 40, 1 : 80 and 1 : 160, but all doubtful reactions and check tests were extended in both directions, and frequent use was made of antigens suspended in varying amounts of saline up to 12 per cent. We have avoided adding undiluted serum to the antigen, preferring in all our tests to obtain final dilutions by using a standard serum-saline dilution of 1 : 5. Reactions were interpreted according to the following scale:

Water-clear agglutination	...++++
Almost water-clear agglutination ...	... +++
Distinct agglutination...	... ++
Perceptible agglutination	... +
Doubtful agglutination	... ± ?
Negative agglutination	... —

Water-clear or almost water-clear agglutination in the first tube (1 : 20) is always followed by some degree of reaction in the second (1 : 40) or succeeding tubes, and the diagnosis is positive. Reactions less than almost water-clear may frequently occur in the first tube, but provided there is no sign of agglutination in the second tube the diagnosis is taken as negative. A serum showing any degree of agglutination in a dilution of 1 : 40 was recorded as positive, but if such reactions were doubtful the animals were classified as doubtful and subjected to retest. Reading in this way must be considered a severe test, but we have reason for believing that an agglutination titre of 1 : 20 indicates a transient phase in the animal's economy, and her true status will be revealed by subsequent tests. Consequently, perceptible agglutination in 1 : 40 has always been considered a positive reaction. In cattle which are demonstrably free from *Br. abortus* infection, such as calves or male animals, it is very rare in our experience to get an agglutination reaction in 1 : 10, and, furthermore, our results have convinced us that the above is the correct way to apply and interpret this test.

In view of recent information regarding the variability of rough and smooth variants of *Br. abortus*, a check was kept on our antigens, which were tested according to the technique adopted by Professor Wilson.

Eradication commenced after the July test, but was not intensified until monthly testing was instituted in October, 1930. This was continued up to April, 1931, so that seven complete herd tests were undertaken. The gross results are shown in Table II.

XUM

TABLE II.—BLOOD TESTS ON THE HERD AND PROGRESS OF ERADICATION.

Tests	Date	Number of animals tested	Number of reactors	Per-centage	Doubtful Reactors	Total No. of reactors
First ...	8.7.30	19	6	31	3	9
Second ...	28.10.30	30	5	17	1	6
Third ...	26.11.30	36	3	8	2	5
Fourth ...	21.1.31	36	4	11	4	8
Fifth ...	13.2.31	31	1	3	2	3
Sixth ...	19.3.31	32	2	6	0	2
Seventh ...	22.4.31	40	0	—	0	0
Eighth ...	24.6.31	38	0	—	0	0

This table shows the gradual nature of the eradication process, and illustrates the value of monthly tests. Three months elapsed between the first and second tests, and meanwhile five cows had progressed to a positive reaction, two of which, however, were previously doubtful. The last column of the table shows that the total number of reactors steadily declined, except at the fourth test, when there were eight reactors. The fourth test followed an interval of two months, and had it been possible to have tested the herd in December, 1930, it is obvious that several or all of these reactors might have been detected and removed from the herd one month earlier. Latent reactions in the clean unit, while they are always to be expected, are troublesome and frequently difficult to explain, and since they cause a severe tax on the morale of the dairy staff at a critical time, must be guarded against by close supervision and by monthly tests.

It has already been stated that a doubtful reaction is one showing doubtful agglutination in a serum-antigen dilution of 1 : 40. Experience has shown us that such reactions indicate a transient phase, and that while some animals may revert to a negative status, most of them proceed to become positive reactors. The twelve doubtful reactors in Table II refer to ten animals (two animals were doubtful on successive tests) and of these, seven became positive within two months, two were sold without further testing, and one animal became negative, and has since remained negative. Sometimes a doubtful reaction will quickly change to positive, as in cow 45, whose reaction proceeded from doubtful in 1 : 40 to water-clear in the same dilution in sixteen days. Consequently, where accommodation does not permit of three separate units for the healthy, infected, and doubtful animals, it is safer to regard the latter as already infected.

All breeding animals in this herd have been blood tested bi-annually since it was freed from the infection in 1931. For a period of two and a-half years there has not been a single positive or doubtful reactor. The owner's veterinary surgeon is exceedingly pleased with the general and breeding health of the herd, and states that since freed from *Br. abortus* infection there have been no cases of vaginitis, mastitis, retained placenta or sterility. In all, twenty cows in calf or in milk have been recruited as replacements to the clean unit, and all have been safeguarded by the double blood test.

XUM

TABLE III.

Tests		Occurrence of Latent Reactions.	
8.7.30 ...	P	Nos. 82, 83, 39, 41, 26, 30 ...	Isolated and sold; No. 26 barren
	D	Nos. 25, **35, 37**	No. 25 sold (barren)
28.10.30 ...	P	Nos. **35, 37,** 43, 4, 33 ...	Three new reactors; isolated and sold; No. 37 barren
	D	No. **40**	Sold
26.11.30 ...	P	91, 44, 92	Three new reactors; isolated and sold; No. 44 barren
	D	Nos. **93, 45**	Isolated
21.1.31 ...	P	Nos. **93, 45,** 94, 95	Two new reactors; No. 45 barren.
	D	Nos. 21, **98, 31, 47**	Isolated; No. 98 barren
13.2.31 ...	P	No. **31**	Isolated and sold.
	D	Nos. **47,** 21	Isolated; No. 21 became negative
19.3.31 ...	P	Nos. **98, 47**	Isolated and sold
	D	——	
22.4.31 ...	No reactors		

P = Positive. D = Doubtful.

The Cost of Eradication.

At the commencement of the experiment it was our intention to collect such data as would enable us to put forward figures representing the cost of eradication. It soon became apparent, however, that this would prove an extremely laborious and complicated task, and as the conditions under which dairy farming is practised are so varied, and as it was obvious that the costs of an eradication policy on one farm might bear no relation to the costs on another farm under different management, we decided to abandon the original intention of keeping cost accounts, and to note only such figures as might be of general interest. The owner of the herd insisted on selling privately all reactors immediately, or soon after, the test proved them to be such. Further, their true status was always declared at sale. Under these circumstances the price obtained was less than would have been realised had the animals been kept and sold in full milk, and consequently the loss on the replacement of cows was greater than it might otherwise have been. Reacting cows were replaced by bought-in stock introduced to the herd after passing successfully two blood tests. Table IV gives particulars of the cows which reacted, including the price obtained for them when sold, and the cost of replacing them with abortion-free cows of equal value in all other respects.

XUM

TABLE IV.—PARTICULARS OF ANIMALS WHICH REACTED, HOW DISPOSED OF, AND COST OF REPLACEMENT.

Cow No.	Reacted	Sold	Price realised £	s.	d.	Cost of replacement £	s.	d.	Loss £	s.	d.	Remarks
82	8.7.30	20.8.30	20	0	0	30	0	0	10	0	0	3 years old
83	Do.	11.8.30	19	0	0	28	0	0	9	0	0	6 do.
39	Do.	15.8.30	24	10	0	31	0	0	6	10	0	5 do.
*26	Do.	11.8.30	17	2	6		—			—		Barren ; no loss
30	Do.	19.11.30	20	0	0	22	0	0	2	0	0	Jersey ; 6 years
41	Do.	19.11.30	20	0	0	45	0	0	25	0	0	Pedigree cow
35	28.10.30	10.11.30	15	2	6	25	0	0	9	17	6	4½ years old
*37	Do.	10.11.30	19	0	0		—			—		Barren ; no loss
43	Do.	31.10.30	24	10	0	36	0	0	11	10	0	5 years old
4	Do.	10.11.30	16	0	0	24	0	0	8	0	0	9 do.
33	Do.	10.11.30	15	2	6	22	5	0	7	2	6	4½ do.
91	26.11.30	26.11.30	18	0	0	20	0	0	2	0	0	2 do.
*44	Do.	9.1.31	13	12	6		—			—		Barren ; no loss
92	Do.	14.1.31	16	0	0	17	0	0	1	0	0	Young cow
93	21.1.31	24.1.31	16	5	0	17	5	0	1	0	0	Do.
*45	Do.	9.2.31	16	10	0		—			—		7 years old ; barren
94	Do.	24.1.31	16	5	0	17	5	0	1	0	0	Young cow
95	Do.	30.1.31	18	0	0	20	0	0	2	0	0	2 years old
31	13.2.31	25.4.31	25	0	0	26	0	0	1	0	0	Barren ; no loss
*98	19.3.31	17.4.31	16	15	0		—			—		Barren ; no loss
47	Do.	25.4.31	27	0	0	27	0	0		—		Young cow
Totals			£310	15	0	407	15	0	97	0	0	
Average (16 animals) :			£6	1	0							

* Not included in totals.

From a study of the table it will be seen that the average loss in the replacement of reacting cows in this herd was £6 1*s*. The greatest individual loss on a cow was on No. 41, which was an expensive pedigreed animal bought originally for the purpose of breeding pedigreed bulls or heifers. Omitting this particular cow, the average loss is reduced by more than £1 per head. Further, had the cows been sold under more favourable conditions, the average loss per cow would have been even less. It will be noted that five cows known to be affected with abortion disease are described as barren. The loss involved in their sale has not been charged to the eradication process, since these animals would in any case have been disposed of as unprofitable.

In this herd it was not necessary to add to existing buildings, and apart from the cost of materials the work of disinfection, fencing, extra keep and attendance on positive and doubtful reactors, etc., was carried out by the existing labour

XUM

of the farm. The fees for veterinary attendance were not increased materially, as the occasions for the bi-annual tuberculin testing of this graded herd were utilised for the taking of blood samples. All intervening samples were taken by ourselves under arrangements with the practitioner. An allowance probably should be made for a quantity of farmyard manure which was diverted from use on the pastures to the market garden. The practice on this farm and district is to sell surplus cows as third calves, and since the eradication of abortion in April, 1930, five cows have been sold privately at a figure corresponding to market value, plus £3 in respect of their being free from tuberculosis and contagious abortion.

Discussion.

Contagious abortion has been eradicated from a commercial herd of dairy cows, and since April, 1930, bi-annual tests have shown that the herd has remained free of the infection. The owner's veterinary practitioner reports that since freed from the disease the general and breeding health of the cows has been excellent. Cows have calved to time, bred regularly, and there has been a gratifying absence of retained placentæ, vaginitis, and sterility, all of which were common prior to 1930. The owner states that the eradication of abortion can be likened to a permanent improvement involving a certain capital expenditure, but inasmuch as eradication has been accompanied by definite benefits, it cannot up to date be held to have been other than profitable. This also is our view.

Eradication presents certain difficulties, foremost of which is the question of the isolation of reactors. In a future article on the subject we hope to deal with the double herd system, but meanwhile will content ourselves by saying that eradication was greatly facilitated by the prompt removal of reactors, not only from the clean unit, but from the farm. Further, we cannot speak too highly of the enthusiastic and able co-operation of the farmer and his staff, who carried out all our instructions immediately and to the letter. The appearance of latent positive reactors in the healthy unit during eradication is troublesome and difficult to explain, and it will be noted that cow 47 reacted positively in March, 1931, or five months after the eradication was intensified. Under the two-herd system the occurrence of latent reactors is even more persistent and eradication of the disease is considerably lengthened.

The occurrence of latent reactors in the clean unit raises the interesting question as to when they become infected—before or after the commencement of eradication. It is well known that cows may abort, and if blood tested within a week or ten days may show no *Br. abortus* agglutinins, although these develop later. This indicates recent infection; but in the case of latent reactors is it possible that the period of incubation of the micro-organism is uncommonly long; or is recent infection more probable? In view of the indefinite information regarding the incubative period it is difficult to say; but under farm conditions, and especially where there are positive or doubtful reactors on the premises, it is always difficult to exclude the possibility of recent infection, and a case was reported at the

XUM

Llandudno Congress where infection had in all probability been transferred by the milker's hands.

Regarding the technique of the agglutination test, we are of the opinion that any reaction in a serum-antigen dilution of 1 : 40 should be regarded with the greatest suspicion. While it is undoubtedly true that some animals will revert to a negative from a doubtful status, it is equally true that most of our doubtful reactors became definitely positive within two months. Consequently such animals should be removed from the clean unit. We have already stressed the importance of monthly testing. It is generally acknowledged that it is possible to eradicate bovine contagious abortion from dairy herds, but in the past it is possible that the difficulties have been overstated, and in this connection it is unfortunate that farmers do not seek professional advice at an earlier date. We believe that an eradication policy should be recommended to owners of tubercle-free herds, as such herds are usually self-contained and the farms equipped with suitable buildings for isolation. The details of good management necessary to combat bovine tuberculosis are, in general, those which will effectively prevent the introduction of contagious abortion. Finally, from the public point of view, if certified milk is to be regarded as the best type of milk available, is it too much to suggest that the herds producing it, in addition to being tubercle free, should also be abortion free ?

Summary and Conclusions.

(1) In a period of about six months contagious abortion was eradicated from a commercial herd of cows. The herd has been free from infection for 32 months. (2) The general and breeding health of the herd is stated to be much better than it was prior to 1930. (3) Eradication of abortion is a practical proposition Monthly blood tests and the isolation of all positive and doubtful reactors is recommended. (4) A doubtful reactor is defined, and in seven out of ten cases noted they quickly progressed to a positive status.

MILK PRODUCTION AND DISTRIBUTION IN RELATION TO NUTRITION AND DISEASE.*

By OLGA NETHERSOLE, R.R.C.,

Founder and Hon. Organiser of the People's League of Health.

THE People's League of Health established in 1930 a special committee to make a survey of tuberculosis of bovine origin in Great Britain with the object of bringing to this important national problem more light than was then available. Among the members of that committee were Professor T. J. Mackie, of the University of Edinburgh ; Dr. Norman Wright, Director of the Hannah Dairy Research Institute, Ayr ; and Professor G. S. Wilson, of the London School of Hygiene and Tropical Medicine. The Royal College of Physicians, The Royal

* Paper read at the British Association Meeting, Leicester, September, 1933.

XUM

College of Surgeons and the British Medical Association also appointed their representatives to serve upon the Committee, of which Dr. W. G. Savage, County Medical Officer of Health for Somerset, was the Chairman.

There is universal agreement that milk as an article of food possesses a high degree of nutritive value, more especially in infancy and childhood. This position is, unfortunately, qualified by the fact that under existing conditions milk may be, and, indeed, actually is, a medium for the conveyance of infections and the production of disease. As the cause of occasional localised epidemics of such diseases as scarlet fever, diphtheria, typhoid, paratyphoid and septic sore throat, milk has without question been proved guilty, and but for constant vigilance by the public health authorities, such experiences would certainly be more frequent. A more sustained and persistent danger is the spread of tuberculosis by the agency of milk. Careful investigations show that on an average, living tubercle bacilli are present in some 6 to 7 per cent. of the parcels of milk distributed in the market for human consumption. As a result, various forms of tuberculosis in children are caused by this milk infection, with a record of some 2,000 deaths annually, and a long chapter of suffering, disability and deformity. The order of events is inevitable: tuberculosis in the cow, bovine tubercle bacilli in milk, tuberculosis of glands, intestines, bones and other organs in children.

Such is a summary statement of the existing position as established by the report of the expert committee of the People's League of Health issued in 1932.

Clearly there rests upon agriculturists and all others concerned the responsibility of considering how so tragic a situation can be redeemed, and it is to this end that the work of the People's League Committee was directed, and continues to be directed.

The manifest ideal would be the removal of the evil at its source, that is, the restriction of the milk supply to cows known to be free from tuberculosis. But all practical persons know that for various reasons this is at present economically and administratively impossible. None the less, it is the goal towards which movement should be encouraged. Given the necessary trouble, resolution and expense, tubercle-free herds can undoubtedly be established and maintained, and legislative and administrative encouragement to this end should be afforded. Specific proposals of this order are set out in the League's Committee's Report, together with the suggestion of lines of research along which the chance of protecting cows against infection by tuberculosis can be explored. Were bovine tuberculosis in milk-yielding cows suppressed, there would be little or no bovine tuberculosis in human beings. All this, however, is for the future, and hardly for the immediate future; and in the meantime the demand for present prevention and protection asserts itself. The blunt position is that here and now children in considerable numbers are being infected with tuberculosis through the milk supply; that the use of milk as a food is in some measure restricted under the fear of this infection; and that no early prospect of an absolutely safe milk supply obtained from untainted sources can be expected.

XUM

It is in view of these facts that the League's Committee has decided that the only wise and reasonable course, pending the development of tubercle-free herds, is pasteurisation, and consequently the Committee's report urges that all raw milk intended for human consumption that does not come from tuberculin-tested herds should be adequately pasteurised; or, if this is impossible, should be sterilised or boiled. Moreover, the Committee would give power to the local authorities, at least in the larger urban areas, to put this rule into practice by demanding that all milk offered for sale within the jurisdiction of the authority should be either from tested cows or should be pasteurised. Apart from detailed results, it is certain (1) that with the enforcement in various cities of pasteurisation the incidence of human tuberculosis of bovine origin, as well as of epidemics of milk-borne diseases, has been substantially reduced; and (2) that physicians and others concerned with the health of children are satisfied after large-scale trials that pasteurised milk is a food of highly satisfactory nutritive value. One or two other considerations require brief notice. The first is that by " pasteurisation " is intended the treatment of the milk in accordance with the regulations prescribed by the Ministry of Health, and not the mere uncontrolled application of heat such as too often claims to effect pasteurisation; in this latter event the label is an inaccurate and misleading one, and cannot be justified.

Again, to advise pasteurisation is not to minimise the demand for strict cleanly and hygienic measures in the preliminary collection and carriage of milk; such measures are essential if a clean and satisfactory milk supply is to be secured. Pasteurisation is not intended to cover either milk of poor quality or milk which is dirty or contaminated by uncleanly and careless methods of collection. Demands in these directions are obviously essential, and the function of pasteurisation is to add to them protection against tuberculosis and other diseases.

In the third place is to be noted the contention that pasteurisation may or does reduce the nutritive value of milk. Laboratory experiments are not altogether self-consistent, and there is no need to claim that the last word on this point has been spoken. But the results of mass observation, as, for example, the supply of pasteurised milk to large towns and to considerable bodies of school children, are more than reassuring; and even if it is true that the vitamin content of raw milk is diminished by heat, there are perfectly simple methods of obtaining compensation if this should be deemed advisable, as, for example, in the feeding of infants.

Let it then be admitted that pasteurisation is not perfection, but a substitute for a perfection that is not yet within reach; that further research may teach us about it something which we do not yet know; that to be made effective the process needs some skill and supervision—admit all this, and it still remains true that by pasteurisation the risk of tuberculous and other infections is reduced, if not to zero, at least to a minimum, and that this end is attained without any appreciable lessening of the value of milk as a food of high value, and practically essential in infancy and childhood. When, as is beyond challenge, pasteurisation

XUM

means the protection of children from the risk of a disease, sometimes fatal, sometimes marked by years of suffering, the claim for its adoption and enforcement is surely an appealing one. Among the many eminent and distinguished members of the medical profession who have publicly associated themselves with the recommendations of the report issued by the People's League of Health are the Rt. Hon. Lord Dawson of Penn, the Rt. Hon. Lord Moynihan of Leeds, the Rt. Hon. Lord Horder of Ashford.

The League, in its attempt to obtain for the community a safe milk supply, one of the most grave public health problems of to-day, and in order to carry its work a stage further than the publication of the report of its survey of bovine tuberculosis in Great Britain, is at present engaged upon an investigation regarding graded milks, with the object of ascertaining to what extent the various forms are tested for tubercle bacilli in Great Britain, and what the results of such examinations have been during the last three years. In view of figures published last autumn showing tubercle bacilli definitely present in a number of samples of graded milks (milks, that is, which have been regarded as specially safe and free from tubercle), it was felt that such a survey would be of value. We have received great help and co-operation from the county and other medical officers of health to whom we have already applied (some 500), and the information supplied to us conclusively proves: (1) That the testing of graded milks for tubercle bacilli is by no means widely practised in Great Britain; (2) that where such examinations have been made the results show that even these guaranteed graded milks are not absolutely above suspicion, in fact tubercle bacilli has been definitely found at times in each of them in many sections of the country.

The conclusions arrived at, therefore, even at this early stage of the League's investigations are: (*a*) That the need of official compulsory periodic expert examination of these guaranteed milks is urgently called for. (*b*) Pending such action by the proper authorities, pasteurisation of these milks, or some other method of treatment by heat for freeing milk from the risk of tubercle bacilli and other infections, is a precautionary measure necessary to establish security. Failing this, the boiling in every household of all such raw milk remains the only means of protection for children from the dangers of this food.

Mention here of the Stassano method is perhaps permissible. Professor G. B. Allaria, of Zorino, Italy, speaking at the Third International Pædiatric Congress held in London in July last, stated: "That experiments conducted in Denmark, France and Italy have shown that with Stassano's method the pathogenic bacterial flora (including *B. coli*) are positively and completely destroyed, that the common bacteria of milk are almost all destroyed, and that the milk retains the smell and taste of raw milk; the enzymes, the bactericidal property, vitamins A, B and C are not destroyed, and the chemical constitution remains almost intact (CO_2 almost totally), also coagulation by rennin and separation of cream." This method is, of course, known to the Ministry of Health, and is doubtless receiving strict investigation.

XUM

The scientific knowledge and discoveries affecting the health of the people which to-day are at our disposal should surely make it possible for the age in which we live to be known to history as the era in which anticipatory action having for its special purpose the prevention of disease, has taken its due place in the promotion of human welfare. Tuberculosis, both human and bovine, is unquestionably a preventable disease, and man may suffer from either; and the human bacilli as well as the bovine can be introduced into the human body by means of milk.

In dealing with practical methods for reducing the possibility of infection, an important point stressed in the League's report of its survey of tuberculosis of bovine origin is the need for adequate medical supervision and control over the health of all engaged in the production and distribution of milk; this would be met by compulsory notification of any infectious or suspicious illness to the medical officer of health. The immediate question is: what are we doing to prevent bovine tuberculosis, or, rather, what may we unwittingly be doing to favour the conditions which bring it about?

In considering the methods of the building of tubercle-free herds in which all cows would regularly pass regulation tests laid down by the Ministry of Health for licences to produce graded milks, the question is forced upon us as to whether the continued application of the tuberculin test may not tend to lower resistance of the cows to tubercle and other diseases with which they may come in contact.

It has been truly stated that, in our desire to reduce and eliminate tuberculosis from our dairy herds, "it must be borne in mind that the high pitch of production expected from milking cows and other stock makes heavy demands upon the resources which, if trouble is to be avoided, must be made good by feeding with a ration perfectly balanced for the purpose." What are we doing in this connection? Milk, it is well known, contains many vitamins—A, B and C. The cow is dependent upon light and air and its food for these vitamins. How have we housed our cows during the winter months? What has been her food ration during the period of gestation? Vitamin A is found in abundance in the fat of milk, and is therefore absent from skimmed milk, so often given to young calves. Let us, then, consider the question of nutrition in relation to infection. I will quote the words of no less an authority than that of the President of this year's meeting of the British Association—Sir Frederick Gowland Hopkins—in an addendum to the report of the League's special committee on bovine tuberculosis, upon which he served in an advisory capacity. Sir Frederick said: "Recent work seems to have shown beyond all doubt that qualitative factors in the diet, whether of man or animal, play an important part in determining the resistance of individuals to bacterial infection; especially would this seem to be true of the influence of vitamin A. It must be admitted that at present such evidence does not relate to the tubercle bacillus in particular; but the evidence strongly suggests that the factor of nutrition must be duly weighed in all studies of tuberculous infection of whatever kind."

XUM

We are assured by medical authorities that breast feeding in the human world by a healthy mother ensures to the child a start in life, equipping it with a resistance and immunity with which to meet infection and disease in its early years, the period described by that great authority on tuberculosis, Sir Robert Philip, of Edinburgh, as " the period of economic necessity for the protection of the virgin soil "—the child, with its minimum power of resistance due to its state of immaturity with probably familial tendencies to be overcome.

Whatever the degree of resistance inherited, this, it must be remembered, can be maintained only by two factors: fresh air, and the pure, safe, perfect food of milk. Let the supply of these be imperfect, and the child's capacity for resistance to infection must inevitably be prejudiced. What is true of the human infant is without question true of the new-born calf. Supplied with milk of inferior quality (as is often the case) it becomes a ready victim to tuberculosis or other infections. To what extent are we guilty in bringing this about?

Except in the case of prize cattle, I believe I am correct in stating that in the past the common custom has been to leave the young calf for one, two or three days, possibly a week, with its mother, to receive the full strength of her milk before the cream has been removed for commercial purposes, and in addition to being shut up in a shed, where light and sun and air scarcely penetrates, has been given as a substitute for the nourishment provided by nature, skimmed milk, that is milk deprived of the element necessary to growth and development, and resistance to infection.

In a word, there is wanting that vitamin A of which our President has written: " That qualitative factors in the diet, whether of man or animal, play an important part in determining the resistance of individuals to bacterial infection; especially would this seem to be true of the influence of vitamin A." How can we expect young calves growing up into heifers to be resistant to tubercle infection when they have been fed on " separated milk " obtained possibly from a re-actor, if not, indeed, from a tuberculous cow, with a little meal thrown in?

Another factor relating to the capacity to resist infection appears when we consider the demand made on the milch cow by the practice of milking for commercial purposes up to within six to eight weeks of the birth of its calf, and sometimes by ignorant or bad farmers even longer. (I have heard of a case continued to within two weeks of delivery, and another when milking never ceased at all.) Are we surprised that it is often immediately after this period, and when she is again being milked for commercial purposes, that a cow shows the first sign of the wasting of tuberculosis, from which she never recovers? She has met the demand made upon her, but she has to pay the price. Nature's laws are unalterable, unrelenting, and when violated are not to be moved by entreaty; and man, or rather his young, have also been called upon to pay the penalty, so inexorable are her laws. Bovine tuberculosis has claimed its young, cutting short the lives of those little human flowers, and crippling and distorting the tiny limbs of others fashioned by nature with such beauty of form and tender

XUM

appeal, making the joy of life a mockery, and that very life a burden. And so the vicious circle goes on.

The economic side of the question cannot be overlooked. The material cost to the nation of bovine tuberculosis, the money paid to farmers in compensation for the slaughter of their infected animals suffering from this and other diseases, and the cost of supporting the hospitals and homes for crippled and sick children suffering from tuberculosis and other milk-borne diseases, these together run into considerably over a million pounds each year. I will not dwell on the suffering of the children or cattle.

I venture very humbly to suggest that the pursuit of research into the low resistance of dairy and other cattle to the tubercle bacillus and other diseases along the following lines may be worthy of note, and might possibly contribute very materially towards the elimination of tuberculosis from our dairy herds. The following are some of the questions to which confident answers are required: (*a*) The possible application and value of genetics in relation to the breeding of dairy cattle. (*b*) The specified time during the period of gestation at which a cow in calf should cease to be milked for commercial purposes. (*c*) The proper food and amount needed by a cow in calf while being milked for commercial purposes, and what difference, if any, should be made during the winter months when the grass is not rich in vitamins owing to the lack of sunshine, and whether there should be any alteration in the kind and amount of food ration of the cow when such milking for commercial purposes has ceased. (This for the preservation of health and strength of the cow, and resistance of both cow and calf to tubercle and other diseases.) (*d*) The length of time a calf should be left with its mother after birth to receive the full strength of her milk, as is the custom in the case of prize cattle, without the cream having been removed for commercial purposes. (*e*) The proper food for the calf when removed from its mother, and amount of such food required by the calf; if milk, this should be obtained from tuberculin-tested cows only. (*f*) Whether a cow should be subjected to the tuberculin test during the period of gestation. (*g*) What interval of time should there be between each tuberculin test of cows. (*h*) At what age should a calf receive its first tuberculin test, and what interval of time should elapse between all subsequent tests. (*i*) How far would Government aid to farmers in the establishment of tubercle-free herds help to eradicate bovine tuberculosis from our dairy herds. I am fully conscious that these considerations are submitted by a lay woman who also does not hold any science degree, but may perhaps react instinctively, due possibly to her sex, to the cause of low resistance of dairy cattle to tuberculosis and other diseases.

In conclusion, I would say that all raw milk intended for consumption in the liquid state should be produced under strict supervision of the Public Health Authority, and periodically examined, and all producers should be licensed, and the milks should be compulsorily treated under the same supervision by some

XUM

method which will ensure freedom from the risk of the spread of disease, and inhibit as much as possible other conditions ensuing, such as bacterial fermentations having a deleterious effect upon the constitution of the milk.

The question as to whether the community has the right or not to demand protection from the possibility, or rather the probability, of having an article of food sold to them containing a subtle and insidious poison such as tuberculosis of bovine origin, which danger we are continually facing everywhere in all parts of the country, due, doubtless, to the custom of dairy distributors buying milk in bulk, which results in the milk from one cow suffering from tuberculosis infecting other milk, possibly of a very high standard and free from such infection; this question should certainly be answered in the affirmative, but the apathy of the people in these matters cannot be overlooked.

Safe milk supply should not be left to the community to deal with or to decide upon. It is the work, the responsibility, of the Ministry of Health, which has not only to concern itself with the public health through the medium of Local Authorities, but is answerable for the health of that community—a much more intimate and personal matter—and I cannot see that any industry, more especially such an important one as the dairy industry, should be shielded or protected against interference where public health is concerned.

SLAUGHTER OF ANIMALS ACT, 1933.

Arrangement of Sections: (1) Provisions as to slaughter of certain animals in slaughter-houses and knackers' yards. (2) Application of last foregoing section. (3) Prohibition of slaughter and stunning except by licensed slaughtermen. (4) Provisions as to slaughter-houses and knackers' yards. (5) Penalties. (6) Employment of slaughtermen by local authority. (7) Inspection of slaughter-houses and knackers' yards. (8) Enforcement. (9) Interpretation. (10) Short title, extent and commencement.

Schedules: First Schedule.—Rabbinical Commission. Second Schedule.—Provisions as to slaughter-houses and knackers' yards.

CHAPTER 39.—An Act to provide for the humane and scientific slaughter of animals; and for purposes connected therewith. [28th July, 1933.]

Be it enacted by the King's most Excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal, and Commons, in this present Parliament assembled, and by the authority of the same, as follows:

1.—(1) No animal to which this section applies shall be slaughtered in a slaughter-house or knacker's yard except in accordance with the following provisions, that is to say, every such animal shall be instantaneously slaughtered, or shall by stunning be instantaneously rendered insensible to pain until death supervenes, and such slaughtering or stunning shall be effected by means of a mechanically-operated instrument in proper repair:

XUM

Provided that no person shall be liable for any contravention of the provisions of this subsection in respect of—

(*a*) the slaughter of any pig, boar, hog, or sow in a slaughter-house or knacker's yard in which there is not available a supply of electrical energy unless it is proved that such a supply could reasonably have been made available ; or

(*b*) the slaughter of any animal slaughtered without the infliction of unnecessary suffering—

(i) by the Jewish method for the food of Jews and by a Jew duly licensed for the purpose by the Rabbinical Commission constituted in accordance with the provisions of the First Schedule to this Act ; or

(ii) by the Mohammedan method for the food of Mohammedans and by a Mohammedan.

(2) This section shall not apply within the area of any local authority to any animal which in that area is exempt from the application thereof under the section of this Act next following, but save as aforesaid this section applies to all animals.

2.—(1) Every local authority shall within twelve months after the passing of this Act consider the question whether they will pass a resolution applying the last foregoing section to all or any of the following animals, that is to say, sheep, ewes, wethers, rams and lambs ; and if such a resolution is at any time (whether within the said twelve months or thereafter) passed by a local authority relating to any such animals, the last foregoing section shall in their area apply to those animals accordingly, but in any area in which no such resolution is in force the said animals shall be exempt from the application of the last foregoing section.

(2) If at any time a resolution is passed by a local authority exempting either goats or kids or both such animals from the application of the last foregoing section in their area, the animals to which the resolution relates shall while the resolution is in force accordingly be exempt in that area from the application of the last foregoing section.

(3) The following provisions shall have effect with respect to any such resolution as is mentioned in the foregoing provisions of this section—

(*a*) not less than twenty-eight days before the meeting of the local authority at which the resolution is to be proposed special notice of the meeting and of the intention to propose the resolution shall be given to every member of the local authority, and the like notice shall also be inserted at least once in one or more of the newspapers circulated within the area of the authority ;

(*b*) a resolution, after being passed, shall be published by advertisement in one or more of the newspapers circulated within the area of the local

XUM

authority by whom it was passed, and may also be published otherwise in such manner as the local authority think sufficient for giving notice thereof to all persons interested ;

(*c*) a copy of every such resolution passed by a local authority shall be sent to the Minister of Health ;

(*d*) any such resolution passed by a local authority may be rescinded or varied by a subsequent resolution, but the foregoing provisions of this subsection shall apply with respect to any such subsequent resolution.

(4) The following provisions shall have effect with respect to any alteration of the areas of local authorities, that is to say :

(*a*) any resolution in force under this section in the altered areas shall—

(i) as respects any areas reduced, continue in force until rescinded or varied by the local authority ;

(ii) as respects any areas extended, apply for a period of three months after the extension (unless rescinded within that period) to the whole of the area extended and shall then be deemed to be rescinded as respects the whole area unless in the meanwhile a new resolution has been passed by the local authority ;

(*b*) if at any time a local authority is newly constituted or the area of any local authority is extended, the local authority shall consider the question specified in subsection (1) of this section within three months after the constitution of the authority or after the extension, as the case may be.

3.—(1) No animal shall be slaughtered or stunned in a slaughter-house or knacker's yard by any person who is not the holder of a licence granted by a local authority, and in force under this section :

Provided that this subsection shall not apply with respect to the slaughter of any animal under the Diseases of Animals Acts, 1894 to 1927, by an officer of or person employed by the Minister of Agriculture and Fisheries.

(2) No licence shall be granted under this section except to a person of the age of eighteen years or upwards who is, in the opinion of the local authority, a fit and proper person to hold such a licence.

(3) A licence under this section shall be in force for such period not exceeding three years as may be specified therein and may be renewed from time to time at the discretion of the local authority.

(4) A licence shall be in force in the district of the local authority granting the license and also in the district of any other local authority, and the licence shall be produced on demand for inspection by such other local authority.

(5) The local authority may suspend the operation of a licence within their area at any time for such period as they may determine and, where they are

XUM

satisfied that the person is no longer a fit and proper person to hold a licence, the local authority by whom the licence was granted may revoke the licence.

(6) Any person aggrieved by the refusal of the local authority to grant or renew a licence or by the suspension or revocation by the local authority of a licence may appeal to a court of summary jurisdiction against such refusal, suspension, or revocation, within one month of the intimation thereof, and the decision of the court of summary jurisdiction shall be final.

(7) A fee, not exceeding two shillings, may be charged by the local authority for each such licence, and a fee, not exceeding one shilling, for every renewal thereof.

(8) The provisions of this section shall apply to any licence granted by the local authority for the purpose of the provisions of this Act with regard to the Jewish and Mohammedan methods of slaughter.

(9) Any person applying for a licence shall in such application state—

(*a*) whether he holds a licence granted under this Act in any area or areas other than that to which his application relates and the names of any such areas ;

(*b*) whether he has been refused a licence or has had a licence suspended or revoked in any other area and, if so, the name of that area ; and

(*c*) whether he has any similar application pending in any other area and, if so, the name of that area.

4. The provisions set out in the Second Schedule to this Act shall apply to all slaughter-houses and knackers' yards.

5. If any person slaughters or stuns, or attempts to slaughter or stun, an animal in a slaughter-house or knacker's yard in contravention of the provisions of section one or of subsection (1) of section three of this Act, or knowingly makes any false statement for the purpose of obtaining a licence under this Act, or contravenes or causes or permits any contravention of the provisions set out in the Second Schedule to this Act, he shall be liable on summary conviction to a fine not exceeding ten pounds, or on a second conviction to a fine not exceeding twenty pounds, or on a conviction subsequent to a second conviction to imprisonment for a period not exceeding three months or to a fine not exceeding twenty pounds, or to both such imprisonment and fine :

Provided that a person shall not be liable for any such contravention as aforesaid if he proves that by reason of an accident or other emergency the contravention was necessary for preventing physical injury or suffering to any person or animal.

6. Any local authority who have provided or established a slaughter-house may, if they think fit, employ persons to slaughter or stun animals, in accordance with the provisions of this Act, and may make such charges as they consider reasonable for the services of the persons so employed.

XUM

7.—(1) Any medical* officer of health or any sanitary inspector, duly appointed by a local authority in whose area the slaughter-house or knacker's yard is situated, may enter any slaughter-house or knacker's yard in the district of the local authority at any time when business is or appears to be in progress, or is usually carried on therein, for the purpose of ascertaining whether there is or has been any contraventions of the provision of this Act, and if any person shall refuse to permit any medical* officer of health, or sanitary inspector, to enter any premises which he is entitled to enter under this Act, or shall obstruct or impede him in the exercise of his duties under this Act, he shall be liable on summary conviction to a fine not exceeding five pounds.

(2) This section shall not apply with respect to any slaughter-house or knacker's yard which for the time being is or is comprised in an infected place within the meaning of the Diseases of Animals Acts, 1894 to 1927.

8.—(1) The local authority for the purpose of enforcing the provisions of this Act shall, as regards the Metropolitan Cattle Market in the metropolitan borough of Islington and as regards the city of London, be the common council of the city of London, and as regards their respective areas, the councils of the metropolitan boroughs and county boroughs, and boroughs and urban and rural district councils, and it shall be the duty of every such local authority to enforce the provisions of this Act within their area.

(2) The expenses of enforcing this Act shall be defrayed in the case of the common council of the city of London and metropolitan borough councils, out of the general rate, and in the case of other councils, as expenses incurred in the administration of the Public Health Acts, 1875 to 1926.

9. In this Act the following expressions have the meanings hereby respectively assigned to them, that is to say:

"Animal" means any horse, mare, gelding, pony, foal, colt, filly, stallion, ass, donkey, mule, bull, cow, bullock, heifer, calf, steer, ox, sheep, ewe, wether, ram, lamb, pig, boar, hog, sow, goat or kid.

"Contravention," in relation to any provision of this Act, includes a failure to comply with that provision.

"Knacker's yard" means any building, premises or place used in connection with the business of killing animals not killed for butcher's meat.

"Local authority" means a council having under this Act the duty of enforcing the provisions thereof.

"Mechanically operated instrument" includes an instrument for stunning by means of electricity.

"Slaughter-house" means any building, premises or place used in connection with the business of killing animals for butcher's meat.

* By a strange lapse of understanding, the words "or veterinary" have been omitted from this paragraph. Surely the veterinary officer is, from his knowledge and training, the proper person to give advice upon the diseases of animals and animal flesh. This cannot remain unaltered, and *must* be amended.—Ed. V. J.

XUM

10.—(1) This Act may be cited as the Slaughter of Animals Act, 1933.

(2) This Act shall not apply to Scotland or Northern Ireland.

(3) This Act shall come into operation on the first day of January, nineteen hundred and thirty-four.

SCHEDULES.

First Schedule.—Rabbinical Commission.

The Rabbinical Commission for the licensing of Shochetim (Jewish ritual slaughterers) shall be forthwith set up constituted as follows :—

The Chief Rabbi of the United Hebrew Congregations of the British Empire for the time being who shall be the permanent chairman ;

One member to be appointed by the Spanish and Portuguese Synagogue (London) who shall be a vice-chairman ;

Three members to be appointed by the Beth Din appointed by the United Synagogue (London) ;

Two members to be appointed by the Federation of Synagogues (London) ;

One member to be appointed by the Union of Orthodox Hebrew Congregations (London) ;

Two members to be appointed by the president for the time being of the London committee of deputies of British Jews to represent provincial congregations.

The commission shall be entitled to exercise its functions notwithstanding any vacancy in its constitution, and four members shall form a quorum.

Second Schedule.—Provisions as to Slaughter-houses and Knackers' Yards.

(1) Every person engaged in driving or bringing any animal to the place of slaughter shall—

(*a*) avoid, so far as practicable, driving or bringing the animal over any ground which is likely to cause the animal to slip or fall ; and

(*b*) otherwise adopt such methods and precautions as will prevent the infliction upon the animal of unnecessary suffering and pain.

2. Every occupier of a slaughter-house or knacker's yard shall cause every animal brought to such slaughter-house or knacker's yard for the purpose of being slaughtered to be provided with a sufficient quantity of wholesome water, and when it is necessary to confine any such animal for a period exceeding twenty-four hours with a sufficient quantity of wholesome food.

(3) Every occupier of a slaughter-house or knacker's yard and every servant of such occupier and every other person employed upon the premises in the slaughtering of cattle, shall, before proceeding to stun any horse, mare, gelding, pony, foal, colt, filly, stallion, ass, donkey, mule, bull, ox, bullock, cow, heifer, or steer, cause the head of such animal to be securely fastened in such a position as to

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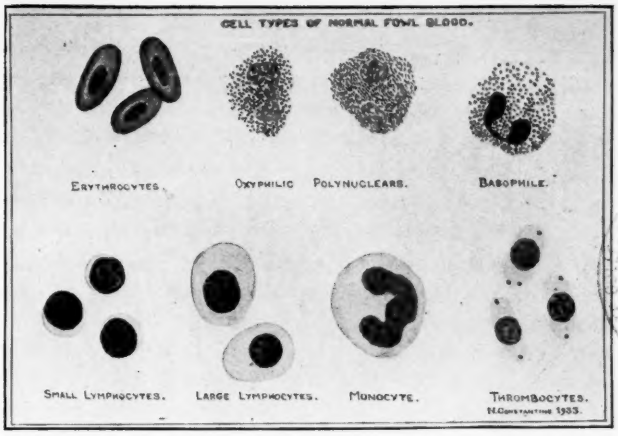

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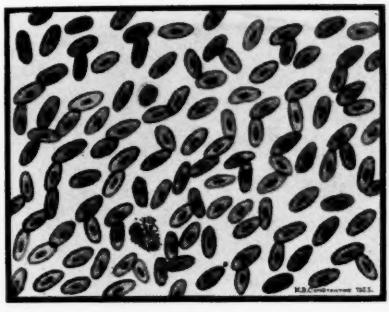

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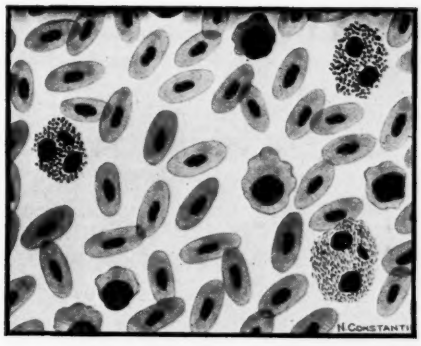

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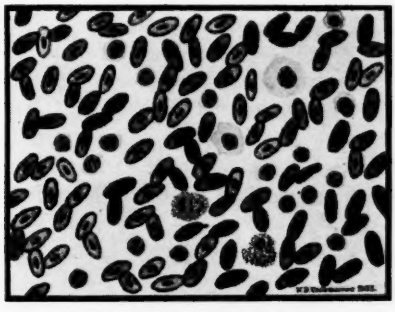

Lymphocyte Phase.

(Article by E. A. Seagar, M.B., Ch.B., D.T.M. & H., *page* 557)

XUM

XUM

enable such animal to be felled with as little pain or suffering as practicable, and shall in the process of slaughtering any animal use such instruments and appliances and adopt such method of slaughter, and otherwise take such precautions as may be requisite to secure the infliction of as little pain and suffering as possible.

4. A person shall not so far as is practicable without structural alteration to premises existing at the passing of this Act, slaughter, or cause or suffer to be slaughtered, any animal in the view of another animal.

(5) A person shall not use any instrument for slaughtering or stunning any animal unless his ability and physical condition qualify him to use it without inflicting unnecessary pain on the animal, nor shall he use a mechanically-operated instrument in such manner or in such circumstances or in such a state of want of repair as to incur the risk of causing unnecessary suffering to an animal.

6. An occupier of a slaughter-house or knacker's yard shall not (so far as it is reasonably practicable to avoid it) cause or allow any blood or other refuse to flow from such slaughter-house or knacker's yard so as to be within the sight or within the smell of any animal in the slaughter-house or knacker's yard, and he shall not cause or allow any such blood or other refuse to be deposited in the waiting pens or lairs so far as it is reasonably practicable to avoid it.

CELLULAR REACTIONS IN THE BLOOD IN NEURO-LYMPHOMATOSIS GALLINARUM (FOWL PARALYSIS).*

By E. A. SEAGAR, M.B., Ch.B., D.T.M. & H.

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THE cytological investigation of the blood can in some conditions of disease serve as a useful aid and index in clinical diagnosis and prognosis. The examination includes the enumeration of the red and white cellular elements, a differential percentage count of the various types of constituent cells, and a study of the morphological characters and staining reactions of the individual cells. The examination of the blood is frequently of service in avian pathology, as there are several conditions which occur quite often, such as the leucoses, in which a smear from the living bird, or a drop of blood taken from the chambers of the heart after death, will, by the salient abnormal cytology exhibited, enable differentiation to be established from other conditions which may be clinically or pathologically confusing.

Early in research work on fowl paralysis it was deemed advisable to clearly separate the condition from forms of leucoses. It became apparent that in active fowl paralysis there was an abnormal reaction of white cells in the blood that

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XUM

differed from the blood pictures seen in leucotic conditions. The question of alteration in total blood cell counts was investigated over a large number of cases, and the differential leucocyte count was carefully done in an extensive series of all stages of fowl paralysis. This was undertaken as it appeared to be a method by which a poultry breeder could remove from his flock, or abstain from breeding from, those birds which showed certain types and degrees of cellular reaction. By this means it appeared feasible to mark out those birds in the flock which showed the reaction to active infection, especially such types as the autonomic nerve and visceral cases, which so often escape detection, as well as the more apparent motor-trunk paralysis cases in which the wings or legs are involved. It would also be of value to ascertain activity of infection in those cases of depigmentation of the iris which have not advanced to fixation of the pupil, as this eye condition may with some strains be confused with birds showing a light iris as a genetic dominant. Furthermore, if it could enable the cases to be culled during the incubation or invasion of the disease, it would effect the removal of the bird during what is possibly the most potent phase for the dissemination of infection.

Technique.

Hæmocytometer pipette dilutions for total red and white cell counts were usually made in the laboratory, but a number were made from potassium oxalate tubes, which were taken in the field and diluted afterwards. This method, however, was abandoned, as discrepancies became evident owing to partial coagulation of the blood. Blaine's solution was used as a diluent in all total counts. The smears were taken from the second drop of blood exuding from the punctured wattle or wing vein. The drop, about the size of a pin's head, was spread along one slide by the edge of another slide used as a spreader, held at an angle of about 45 degrees. The stains most commonly used were Jenner's, or Jenner's followed by concentrated Giemsa. This latter method consists of staining for about two minutes with Jenner, which facilitates granular staining, followed by Giemsa for four minutes, thus demonstrating the nuclear structures more clearly.

In total white counts of avian blood, the greatest difficulty is the inability to lyze the erythrocytes as they are nucleated. In differential counts the platelets are the largest factor of error, as they can be mistaken for small lymphocytes, and numbering as they do about 45,000 per cubic millimetre, the potentiality of error is great. The enumeration of the monocytes is also a rather difficult procedure, and this is evidenced by the fact that various observers who have recorded average counts of normal fowl's blood have assessed the monocyte or large mononuclear count at figures varying from 5.5 to 23 per cent. From this it would appear that some of the series of large lymphocytes, or even intermediate lymphocytes, have been the uncertain factor in the calculations. In the following counts, only those cells showing a fainter staining chromatin in a nucleus of ovoid or indented shape, and with a cytoplasm of a frosted or ground-glass opacity, in short, a monocyte comparable to the standard pertaining in mammalian blood, have been included in the monocyte count.

XUM

The Correlation of Abnormal Figures with Pathological Changes.

The outstanding difficulty in the first place was to arrive at an average normal standard for cellular constituents in fowl's blood. All computed figures by various workers disagree so widely that work was undertaken to estimate the cellular

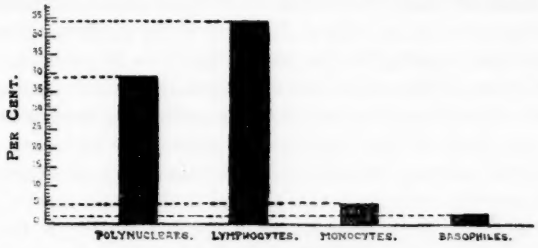

FIG. 1.—Average Normal.

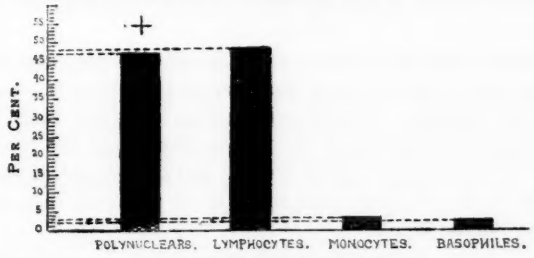

FIG. 2.—Polynuclear Phase.

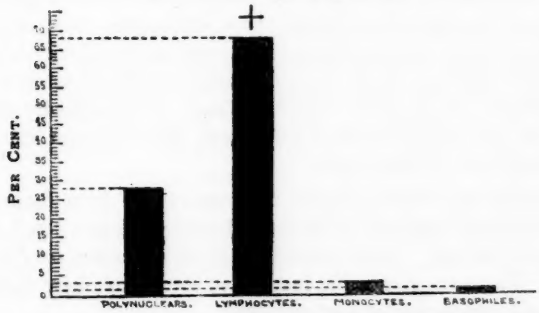

FIG. 3.—Lymphocyte Phase.

counts of fifty samples of normal birds taken from flocks that clinically were free from disease, and where no incidence of fowl paralysis had occurred. The total erythrocyte count averaged 2,900,000 per cubic millimetre, and the average total leucocyte count 27,000 per cubic millimetre. Platelets averaged 45,000 per cubic millimetre. The clotting time of normal blood is too variable to be of any value, but may be taken roughly as averaging thirty seconds. The normal

XUM

differential leucocyte count gave an average of polynuclears, 39 per cent. (of which 5 per cent. are true eosinophiles); large and small lymphocytes, 54 per cent. (of which there are about three small to one large); monocytes, 5 per cent.; and basophiles, 2 per cent.

Some hundreds of cases of fowl paralysis were examined hæmatologically. There did not appear to be any radical alteration in the erythrocyte count, but the leucocyte count was increased on the average by 20 to 30 per cent. At first the more advanced cases of iritis and motor-trunk paralysis were examined, and these usually showed a lymphocytosis; but later the earlier and more acute cases were investigated, and many of these evidenced a polynuclear increase. Finally, the blood of birds that had been injected with inoculum from active cases were examined after two months, and these also showed a uniformly marked polynuclear reaction. Often where birds have shown a marked leucocytic reaction in the blood, but no clinical signs of fowl paralysis, they have on post-mortem examination shown marked infiltration of the autonomic nerves supplying the intestines or other viscera.

Naturally, these cellular reactions are not specific, because any septic process will promote a polynuclear reaction, and several conditions can be responsible for a lymphocytic increase. Careful examination of fasting birds showed that there was a lymphocyte diminution in this condition, but the lymphocytes do not rise above the average normal on feeding and subsequent digestion. There does not appear to be the lymph-tide of 15 to 30 per cent. that occurs during digestion in the human being.

From extensive investigation it would appear that the polynuclear increase or polyphase occurs during late incubation, and the early acute stage of the disease and the lymphocytic reaction or lymph-phase, during the more advanced manifestations, such as iritis, motor-trunk paralysis and autonomic nerve involvement. These indications may be of use in the examination of a flock known to be infected with fowl paralysis, as an aid to clinical culling. The markedly affected birds can be removed, the suspicious birds segregated, and the clean normal birds set apart as a foundation breeding stock.

The accompanying column graphs are constructed from figures computed from counts of several hundreds of birds, and may serve as a rough guide to the interpretation of findings. Three hundred cells were counted over average fields of each film. There are no specific features in the morphology of the cells that are infallibly pathognomonic of fowl paralysis.

Johnson and Conner (1933) have recorded the prevalence of "budding" lymphocytes, a marked monocytosis, and also a basophilia, as features of the blood in neuro-lymphomatosis; but extensive observations do not tend to support these findings as being specific reactions. Certainly the "budding" of lymphs is a feature sometimes seen, but it appears to occur in normal avian blood to a less degree. It occurs occasionally more markedly when there is an absolute or even relative lymphocytosis, but it is doubtful whether, apart from showing

XUM

lymphocytic activity, it can be accepted as a pathogenic index. In the same way basophilia, which is certainly sometimes seen in the blood in fowl paralysis cases, is, when manifest, merely an indication of toxic action on the granulocytes. A monocytic increase has not been observed.

These observations are intended merely as a preliminary note, as wider investigation of the changes is in progress.

Thanks are tendered to the Director of the Laboratories, and also to Mr. N. D. Constantine, research assistant, for his collaboration in the work, and for the drawings from which these illustrations were taken.

REFERENCE.

Johnson, E. P., and Conner, B. V., 1933: *Jl. Am. Vet. Med. Assn.*, 36, 3.

INVESTIGATIONS CONCERNING THE B. PULLORUM AND BACTERIA PERTAINING TO THE SALMONELLA GROUP.*

By L. BAHR, V.M.D., and N. P. C. CHRISTENSEN, V.S.

As is known, the bacteria that most frequently can be demonstrated as the cause of contagious enteritis in chickens and hens (Bacillary white diarrhœa of chicks, pullorum, fowl typhoid, etc.) are the *B. pullorum* and the *B. sanguinarium* (*seu B. typhi gallinarum alkalifaciens*). Besides these, certain other bacteria can, in rarer cases, be found in contagious enteritis in chicken, *viz.*, certain Salmonella bacteria, such as the *B. aertryck*, the *B. paratyphus-B*, and the *Br. abort. equi*, whilst it is extremely rare that bacteria pertaining to the Gaertner group can be demonstrated.

The *B. coli* was regarded by earlier researchers as a not infrequent cause of intestinal disorders in birds, but van Heelsbergen[1] is of opinion that the finding of coli bacilli in the organs and blood of diseased birds as a rule is due to invasion during the stage of agony of coli bacilli that are present in the intestinal canal under normal conditions. He does not, however, consider it out of the question that the *B. coli* under certain circumstances may become virulent to birds and engender disease in the latter, and such cases have also been reported.[2]

In order to demonstrate that chickens, and especially hens, are infected with the *B. pullorum* and the *B. sanguinarium*, the agglutination test is now as a rule employed, and it is possible to demonstrate the great majority of chronically infected hens (carriers), so that we become enabled effectively to combat the typhoid disorders in infected stocks of hens and chickens. It is, however, impossible on a single examination to find all the infected hens and chickens, as the agglutinin contents of the blood are inconstant, and may vary, even rather considerably, in the different seasons of the year. The fluctuations may be so large as to make it impossible during certain periods to demonstrate specific agglutinins in the blood (N. P. C. Christensen[3]).

* From the State Veterinary Serum Laboratory, Copenhagen. (Director—Professor C. O. Jensen, M.D., N.C. and V.M.D., *h.c.*).

XUM

Although the prevailing idea is that good results are arrived at on the basis of the agglutination test, some researchers (Beach, Halpin and Lampman[4]) are, however, of opinion that this method is quite useless as a diagnostic means. Below we shall approach the question further. The titre that is made the basis of the diagnosing of typhoid disease in hens and chickens is stated with rather different figures by the researchers who have worked with the agglutination test. Jones[5] (and, later on, Gage, Miessner and Schmidt-Hoensdorff) only consider the reaction a positive one when the titre is 1–100, whilst now an agglutination titre of 1–50 is considered a positive one, whereas an agglutination titre of 1–25 must be considered a doubtful reaction.

The fact has been referred to that the agglutinin contents of the blood of hens and chickens may vary considerably; the significance of the agglutination test is, of course, reduced by this fact; it would, however, be worse if the infections engendered in hens and chickens by the said Salmonella bacteria were of frequent occurrence, as the same " O " antigen that is found in the *B. pullorum* and the *B. sanguinarium* also has been demonstrated in the *B. typhosus*, the *B. enter. gaertner*, and the following other Salmonella types: Dublin, Moscow, Dar-es-Salaam, and Tokyo (White, 1926, 1929). " It is evident, therefore (says C. A. McGanghey[6]), that the agglutination test as ordinarily carried out for the detection of carriers of *B. pullorum* may not be specific for this organism." This, of course, is correct; but the question is, how great importance we should attach to this fact.

In order to elucidate this important matter, and this cannot be said to be without importance to the practical value of the agglutination test as a diagnostic means in typhoid in hens and chickens, we have carried out a number of agglutination examinations with sera of spontaneously infected hens sent from seven Danish poultry farms to the State Veterinary Serum Institute in Copenhagen; the examinations comprised the following antigens: *B. pullorum*, *B. aertryck*, *B. typhosus*, *B. paratyphus-B.* (Schottmüller), *B. paratyphus-A* (Schottmüller), *Br. abort. equi*, *B. suipestifer*, *B. enter. gaertner: Typ. Danysz* (" Ratin "), *B. enter. gaertner: Typ. Jensen* (Paracoli), and *Flexner-D*, *Flexner-H* and *paradysentery* (Sonne). The 102 sera (from as many hens and chickens) that were used showed the following reactions in the agglutination tests with the *B. pullorum*:

Dilution of serum	1.25	Agglutination	+++	Sera from hens and chickens		6
„ „ „	1.50	„	++++	„ „ „		16
„ „ „	1.100	„	++++	„ „ „		16
„ „ „	1.200	„	++++	„ „ „		25
„ „ „	1.500	„	++++	„ „ „		12
„ „ „	1.1000	„	++++	„ „ „		18
„ „ „	1.2000	„	++++	„ „ „		9

If 1.25 is regarded as an uncertain and 1.50 as a certain reaction, this means that 96 out of these 102 sera gave a positive reaction with titres from 1.50 to 1.2000.

XUM

TABLE I.

Antigen	*Titre 1/20 or less. Number of sera	*Titre 1/10. Number of sera	*Titre 1/8. Number of sera	*Titre 1/5. Number of sera	*Titre 1/4. Number of sera	*Titre 1/2. Number of sera	Titre equal to that of *B. pullorum* Number of sera	Titre twice as high as that of *B. pullorum*. Number of sera	Titre more than twice as high as that of *B. pullorum*. Number of sera	No agglutination. Number of sera	Number of sera. Total
Gaertner Danysz ("Ratin") Copenhagen	1	3	1	7	12	32	16	1	2	11	86
Gaertner Jensen (Paracoli) Copenhagen ...	1	9	3	12	9	13	2	...	...	15	64
B. aertryck (Andrewes) London	6	7	...	1	2	1	1	...	...	35	53
B. typhosus	...	...	...	...	1	...	...	...	...	14	15
Paratyphus A. (Schottmüller	...	...	...	...	1	...	...	...	...	12	13
Paratyphus B. (Schottmüller)	...	...	...	...	...	5	9	5	1	2	22
Br. abortus equi ...	...	...	...	...	3	...	8	7	2	2	22
B. suipestifer	...	...	...	...	...	...	...	...	...	38	38
Flexner-D.	...	...	...	...	...	...	...	...	...	6	6
Flexner-H.	...	...	...	...	...	...	...	...	...	6	6
Paradysentery B. (Sonne)	3	...	...	...	...	...	...	...	...	3	6

* By titre 1/20, 1/10, 1/8, 1/5, 1/4, 1/2, etc., is understood that the antigens referred to here were agglutinated to a titre level corresponding to 1/20 (or less), 1/10, 1/8, 1/5, 1/4, 1/2 of the one to which the *same* chicken sera agglutinated the *B. pullorum*.

Table I shows the parallel agglutination experiments performed with 98 of these sera on *pullorum* antigen and the Salmonella bacteria and paradysentery bacilli referred to, and the extent to which the said antigens were agglutinated by these sera (if agglutinated at all) in proportion to the titres ascertained for the *B. pullorum* with the same sera. In reality this table speaks for itself, and no additional comments are required. None of the *pullorum* chicken sera that were tested agglutinated *B. suipestifer*, *Flexner-D* or *Flexner-H*, and only three of the six sera examined gave a reaction with *paradysentery*-Sonne, but only to a slight extent. Nor was a reaction observed with *B. typhosus* or *paratyphoid A* antigen, except in the case of both antigens with two sera that agglutinated both 1–50; but this was to a considerably lower titre than the *B. pullorum*.

In the case of the *B. paratyphus-B* and the *Br. abort. equi* a considerable reaction was observed, 15 out of the 22 sera examined agglutinating this first antigen to an equally high, or twice as high or even higher, titre than the *B. pullorum*. Seventeen out of the 22 sera examined agglutinated the *Br. abort. equi* to an equally high titre as the *B. pullorum*, or still higher. The *B. aertryck* was not agglutinated by 35 out of the 53 sera that were examined, this antigen thus being agglutinated by comparatively few *pullorum* sera only; 10 of the sera agglutinated the *B. aertryck*, but only to a slight extent, and only as far as eight sera were concerned a stronger reaction was observed. One of these sera agglutinated the *B. aertryck* as much as the *B. pullorum*.

The value of the agglutination reaction was high, too, in the case of the types of the *B. enter.* Gaertner group of bacteria (Gaertner Jensen, Paracoli, and Gaertner Danysz, "Ratin"), as no small number of sera agglutinated these antigens to rather high values, some even to the titre limit, and some even higher than the *B. pullorum*. As a control we have at the same time performed agglutination experiments with 54 chicken sera from five healthy, *i.e.*, not reacting stocks. The results of these examinations will appear from Table II.

TABLE II.

Stock	Number of Sera	Pullorum Antigen	Ratin Antigen	Paracoli Antigen	Parat. Schott-müller-B Antigen	Parat. Schott-müller-A Antigen	*Parat. abort. equi* Antigen	*B. Suipes-tifer* Antigen	*Aertryck* Antigen	Typhoid Antigen
I	12	0	0	0						
II	12	0	0	0						
III	6	0	0		0		0			
IV	12	0	0	0				0	0	
V	12	0	0			0			0	0

As will be seen, agglutination with these sera was not observed in any of these cases. Agglutination examinations were, moreover, performed with *Flexner-H* and *paradysentery*-Sonne; six sera from stock No. III being used for this purpose too. Agglutination was not observed in any of these cases either as far as these antigens are concerned. In all the experiments a serum dilution of 1–25 was employed.

We are thus in complete correspondence with the researchers who in the case of typhoid in hens and chickens consider the agglutination reaction as not specific.

XUM

TABLE III.—FEEDING EXPERIMENTS WITH VIRULENT RATIN CULTURES ON CHICKENS.

Series	No. of chickens	Age when infected	Infected per os with ratin culture	Dose of ratin culture per chicken	Way of administration of the culture	Observed daily up till	Comments	Blood sample for agglutination examinations was taken	Result of agglutination examinations with *B. pullorum*	Result of agglutination examinations with ratin culture	Anatomico-pathological and bacteriological examinations
I	9	4–8 weeks	21/7 and 22/7, 1932	4 weeks old chickens 25–30 gm. 8 weeks old chickens 50 ccm.	Mixed with the feed (bread-chicken feed)	9/8/1932	None of the chickens has been ill. The inclination to eat was good and the motions were normal all the time	From all 9 chickens 9/8/32	——	10/8/1932 : 9 sera from 9 chickens : 1.50, 1.100, 1.200 ; no agglutination	The 9 chickens were killed 9/8/32. Organs and intestines normal. No ratin bacilli were demonstrated on inoculation from intestines, blood, spleen and liver
II	4	24 h.	20/6/33	0.01 ccm.	Direct per os with papillary pipette	22/9/33	Ditto	From all 4 chickens : 29/6, 4/7, 13/7, 27/7, 10/8, 25/8 and 22/9, 1933	4 chicken sera : no agglutination ; 1.25, 1.50, 1.100	Sera of 4 chickens ; no agglutination ; 1.25, 1.50, 1.100	The 4 chickens still live and are in full health
III	8	24 h.	20/6/33	0.05 ccm.	Ditto	22/9/33	Ditto	From all 8 chickens : 4/7, 13/7, 27/7, 10/8, 25/8 and 22/9, 1933	8 chicken sera : no agglutination ; 1.25, 1.50, 1.100	8 chicken sera : no agglutination ; 1.25, 1.50, 1.100	The 8 chickens still live and are in full health
IV	5	24 h.	20/6/33 Not infected	—	—	22/9/33	One chicken died 23/6, but not of ratin infection. The remaining 4 chickens were not taken ill	From the 4 chickens : 4/7, 13/7, 27/7, 10/8, 25/8 and 22/9, 1933	4 chicken sera : no agglutination ; 1.25, 1.50, 1.100	4 chicken sera : no agglutination ; 1.25, 1.50, 1.100	The 4 chickens, still live and are in full health

But we are not in correspondence with these researchers when they conclude from this fact that the reaction is useless as a diagnostic means.

It is true that it may give rise to mistakes in cases of *B. paratyphus-B.*, and in a few cases of *B. aertryck* infections in hens and chickens; but cases of paratyphoid-B infections in hens and chickens are not frequent, and even if the Aertryck infections are of a more frequent occurrence they must still be said to be of a relatively rare occurrence in comparison with the *B. pullorum* and the *B. sanguinarium* infections. Moreover, it seems to be rare that just the *B. aertryck* gives rise to the formation of such agglutinins in the blood sera of hens and chickens to any embarrassing extent. The *Br. abort. equi* infections, which perhaps are most properly placed beside the *B. paratyphus-B*, also seem to be rare in hens and chickens, and therefore this fact cannot materially reduce the practical value of the chicken typhoid agglutination test either, even if mistakes, as already referred to, cannot be completely precluded in some cases. The Gaertner bacteria then remain, and if these infections were of fairly frequent occurrence in hens and chickens, they, too, might be able to give rise to erroneous conclusions, at any rate in a number of cases. But as has been referred to above, Gaertner bacillus infections are—one may perhaps say fortunately—extremely rare in hens and chickens, and, therefore, the circumstances referred to cannot play any material part as regards the practical value of the agglutination reaction when the point is to diagnose pullorum infection in hens and chickens. Despite the fact that the agglutination test in chicken typhoid is not so specific as one might desire, it must, however, in our opinion, still be termed sufficiently reliable generally to diagnose chicken typhoid in the stocks of hens and chickens.

What also interests us in this connection is that these rat-killing Gaertner cultures, which often are put out to a great extent to combat rats and mice, also now and then have been employed in poultry farms, and the possibility might therefore be imagined, in view of the circumstances referred to (a possibility that also has been put forward, *e.g.*, by the Goring laboratory*), that this might influence the agglutination reaction in chicken typhoid to a great extent, in so far as chickens and hens might be attacked, and frequently were attacked, by these rat-killing bacteria; and as the consequence hereof was that agglutinins in a number of cases were formed in the blood sera of the hens and chickens, the sera then being able to agglutinate the chicken typhoid bacilli to rather high values, which would be a great nuisance.

The way of infection that was considered must, of course, be peroral. Injection experiments (subcutaneous or i. P., etc.) are of no interest in these considerations, as infection of hens and chickens with the rat-killing Gaertner bacteria only can be imagined through infected water or food.

Owing to the great importance of the question, we have performed some experiments with day-old (twenty-four hour) and older (four- to six-week) chickens,

* The Poultry Pathological Research Laboratory, Goring, Reading, England. In a communication to L. Bahr from W. P. Blount, F.R.C.V.S., co-operator at the said laboratory; a communication that gave rise to our investigations.

XUM

which we have fed on, or given direct per os (with papillary pipettes), highly virulent rat-killing cultures, choosing for these experiments ratin cultures to represent the *B. enter.* (Gaertner, Typ. Danysz) as they were most easily obtained by us, and because these cultures in Denmark are used to a great extent to combat rats and mice in, among other places, the numerous poultry farms, where no ratin infections in hens and chickens have been observed as far as we know.

For the three experimental series stated in Table III, and comprising nine (four- to eight-week) chickens and twelve (day-old) chickens, two ratin cultures were used, *viz.*, ratin No. 639/32 and No. 260/33, both of which had been examined previously with a view to their virulence by means of peroral infection on rats. Thus six white rats were fed on ratin culture No. 639/32, and they all died of the ratin infection after eight to ten days. Ratin culture No. 260/33 was also given to six rats (greyish-brown, *Mus decumanus*), five of which died as a consequence of the infection in the course of eight to eleven days. The sixth rat survived the infection. Both ratin cultures thus possessed a sufficiently high virulence. Ratin culture No. 639/32 was used in the experiments in the first series of experiments, and ratin culture No. 260/33 in the second and third series. All the chickens, which during the whole of the experiment were fed on chicken feed, corn and bread, and got a sufficient supply of water, increased their weight during the period of the experiment.

We want to state that the first series originally comprised ten chickens, but one of them died five days after the infection from another cause, *viz.*, a coccus infection ; ratin bacilli could not be demonstrated in the contents of the intestines, in spleen, liver or blood, but there was, especially in the spleen, a swarm of cocci in pure culture.

The second series of experiments at first comprised five (day-old) chickens, but one of these had to be killed seven days after the infection, as it suffered from a malformed leg. Its organs were completely normal, and after inoculation in agar-agar from heart blood and intestinal contents, no growth of bacteria appeared.

The third series originally comprised ten day-old chickens, but one died on July 1st, 1933. The first days after the infection it was in good health, but then it got diarrhœa. There were no macroscopic alterations of the organs, and after inoculation from them no growth of bacteria was observed. After inoculation from the intestinal contents in agar-agar only, a growth of *B. coli* appeared. On July 15th, 1933, another of the chickens died, having been weak after the blood specimen was taken on July 13th, 1933. It was highly anæmic. No alterations could be observed in the organs, in which no micro-organisms could be observed after inoculation in agar-agar. Thus four chickens in all passed out from the three series of experiments for the reasons stated.

As controls for the chickens stated in Series II and III, five day-old chickens were bought on the same day from the same place, and they lived together with the experimental chickens during the whole of the time of the experiment. One of them died on June 23rd, but the others remained in good health. No macro-

XUM

scopic alterations could be demonstrated in the organs of the dead chicken, and no growth of bacteria appeared after inoculation in agar-agar from the organs.

The result of the experiments with the nine older and the twelve day-old chickens was then *that none of them was attacked by ratin infection, and ratin agglutinins could not be demonstrated in the blood sera of any of the chickens, nor could B. pullorum agglutinins be demonstrated in the case of the day-old chickens.*

As regards feeding experiments with ratin bacteria on full-grown hens, one of the writers (Bahr) has previously fed ten such hens for one to four days successively with great quantities of virulent ratin bouillon culture (50–170 gm. a day). None of these ten hens was attacked by the infection, and ratin agglutinins could not be demonstrated in their blood sera (dilutions of sera : 1 in 40, 1 in 80, 1 in 160, and 1 in 320).

The experiments with twenty-one chickens and ten hens have thus shown that they *were not susceptible to the ratin infection* when the ratin culture was given per os, or was ingested together with the feed, and, therefore, the laying out of rat-killing cultures in poultry farms *cannot be supposed to be of any harmful effect on the agglutination test used for ascertaining chicken typhoid in poultry farms.*

Summary.

(1) An account is given of a series of agglutination examinations with chicken typhoid sera from hens, and the *B. pullorum*, the *B. sanguinarium*, and a number of bacteria belonging to the Salmonella group ; and of some *peroral* infection experiments with ratin bacilli on twenty-one twenty-four-hour-old and nine older (four- to eight-week) chickens, and ten full-grown hens.

(2) These experiments, in correspondence with the examinations of certain earlier researchers, showed that the agglutinin reaction as far as *pullorum* sera are concerned *is not an absolutely specific reaction test.* For certain forms of bacteria of the Salmonella group (*B. paratyphosus-B, B. aertryck, Br. abortus equi*, and the types of the *B. enter. gaertner*) were *also agglutinated more or less by a number of pullorum sera.* This was especially marked in the case of the *B. paratyph.-B.*, and the *Br. abortus equi*, and to some extent in the case of the Gaertner bacteria, as a number of chicken typhoid sera agglutinated these forms of bacteria rather much—as much as, or in the case of some of the sera, even more than, the *B. pullorum.*

(3) The *B. paratyphosus A* and the *B. suipestifer, B. voldagsen* and *Flexner-D* and *-H* were not agglutinated, and the *paradysentery bacilli* (Sonne) only to a very *small* extent by the chicken typhoid sera examined.

(4) As, however, the Salmonella bacteria referred to (*B. paratyphosus-B, Br. abortus equi, B. aertryck* and the Gaertner bacteria), which according to our experiments *may give rise to the formation of disturbing agglutinins* in the blood sera of hens and chickens, *do not engender, or comparatively seldom engender, disease in hens and chickens*, and as the ratin bacillus in our experiments was unable to engender infection in twenty-four-hour-old and four- to eight-week-old chickens

XUM

and hens, or agglutinin formation in their blood sera, we must in our opinion be entitled to conclude from these experiments that the said agglutinins *do not deteriorate the practical value of the agglutination test as a diagnostic means in chicken typhoid.* Erroneous conclusions may, of course, occur in isolated rare cases, as the agglutination test as referred to is not absolutely specific; but such erroneous conclusions must on the whole be regarded as very rare, and therefore without great importance.

(5) When, therefore, a *positive* reaction with chicken typhoid bacilli (*B. pullorum* or *B. sanguinarium*) is observed in a dilution of serum of 1 in 50 or more, we must in our opinion *be entitled to conclude herefrom that the sera in question originate from hens or chickens infected with chicken typhoid.*

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Reviews

THE ANIMAL LOVERS' ANNUAL.

"THE Animal Lovers' Annual" is a new shilling magazine to be found on the railway station bookstalls, or obtained from Messrs. W. H. Smith & Son, Ltd., direct. Its object is to help the Rebuilding and Endowment Fund of the London Veterinary College, and, as a magazine, it is a marvellous shillingsworth.

On the cover, surrounded by a very pretty arrangement of the College football colours (silver and green), there is a splendid reproduction of a photograph (graciously granted for the purpose) of H.R.H. Princess Mary with her favourite little dog, a Cairn terrier named "Peggy."

After a preliminary Foreword by Sir Frederick Hobday, one proceeds to go through some eighty-five pages of most excellent matter and artistically arranged advertisements. The latter include some illustrations of the new College buildings, which are proceeding apace, and of which three are already in daily occupation.

In the compilation of cartoons and stories, Sir Frederick has received the willing assistance of his brother members of the Savage Club, and other animal lovers, the result being the finest collection of sketches which has ever graced a magazine of this kind. In confirmation of this dogmatic assertion, the prospective purchaser has only to know that the names of the artists include George Stampa, Starr Wood, G. D. Armour, Heath Robinson, John Hassall, Lawson Wood, Poy, Fougasse (of *Punch*), Lynwood Palmer, J. A. Shepherd, Brightwell, Cecil Aldin, W. H. Barribal, Bert Thomas, and the late Alfred Leete; whilst the story writers include E. V. Lucas, Beatrice Chase, A. P. Ryley, George Adams, C. B. Poultney and Gilbert Rumbold. Major Misa contributes an article on "Youth and Equitation," John Aldridge on "Greyhounds and Greyhound Racing," and Sir Frederick Hobday himself writes explaining what veterinary science is doing for this country and the Colonies, the title heading being "The Royal Veterinary College as a National Institution." Altogether it is a splendid shillingsworth, and a great effort is being made by a number

XUM

of influential animal lovers who, as masters of hounds and supporters of the Institute of the Horse and its " live wire " adjuncts, the Children's Pony Clubs, are able to do a great deal towards making the sale a success. It is equally suitable for " grown-ups " as for sporting children, and should find a place during this coming Christmas and New Year seasons at every fireside. Copies and further particulars can be obtained direct from Messrs. W. H. Smith & Son, Ltd., Strand House, Portugal Street, London, W.C.2; or from the Secretary, Royal Veterinary College, Camden Town, London, N.W.1. Price 1*s.*, or 1*s.* 3*d.* post free.

Aberrant Thyroid Tissue in the Dog. By HOWEL V. HUGHES, B.V.Sc., M.R.C.V.S., D.V.H., *Veterinary Anatomy Department, The University, Liverpool.*

SO-CALLED accessory thyroid glands lying in the vicinity of the principal gland commonly occur in both man and animals. In man aberrant thyroid tissue is rarely found farther distant than the tongue or the neck region, but in dogs the distance is frequently greater. Swarts and Thompson* have called attention to the prevalence in this species of thyroid glandules existing within the thorax in and around the pericardial sac. The condition is undoubtedly common, but the writer has never seen such a well-defined collection of glandules as in the case here reported. The subject was an adult fox-terrier bitch which had been destroyed for use in the dissecting room. The heart and pericardium were normal except for the presence of a greyish-pink mass about 30 mm. broad lying in a quantity of fat in front of the aorta, between the root of the pulmonary artery and the right auricle, and a polypoid body suspended from the mass in front of the right ventricle. The mass consisted of four distinct lobules varying in size from 6 mm. to 15 mm. in diameter. The fifth polypoid lobule was suspended by a slender vascular cord about 20 mm. long. It was 10 mm. in diameter at its widest part. All five lobules showed a distinct capsule, and they were enclosed in the serous pericardium. The microphotograph was taken from the pedunculated glandule. It shows the capsule covered outwardly by the serous membrane, and the alveoli in the interior. A number of the latter are abnormally large.

Obituary

THE LATE PROFESSOR ALBERT CALMETTE.†

By DR. NEGRE.

FOR generations to come Calmette will be known not only as a man of the laboratory, in which his name will be inscribed in the history of bacteriology side by side with Pasteur, Duclaux and Roux, but as a hygienist with clear conceptions and practical sense who has left lasting marks in the organisation of the struggle against social diseases. Born on July 12th, 1863, Calmette at twenty years of age entered the French Naval Medical Service, and went to China on board the ss. " Triumphante " in the fleet of Admiral Courbet; passed shortly thereafter into the Colonial Service, and was sent to St. Pierre and Miquelon, where he remained two years (1888–89), and instituted a bacteriological technique. In 1890 he entered the Pasteur Institute, and at once showed the scientific imprint of a master by his serious nature: skilful and full of enthusiasm for the research work to which he consecrated his whole energy and abilities as a true Pasteurian, which he gradually became. Pasteur appointed him to Saignon in order to direct the new Institute which was founded in the Indo-

* J. L. Swarts and R. L. Thompson, *Jour. Med. Res.*, Boston, 24, N.S. (19), 1911, p. 299.

† Translated by Lieut.-Col. T. Dunlop Young, O.B.E., M.R.C.V.S., D.V.S.M.

XUM

China colony. The natives of that colony were not only being decimated by infectious diseases, but each year many of them succumbed to the bites of venomous reptiles. Calmette, inspired by the discoveries of Emile Roux and Behring on the toxins and antitoxins, collected the venom of the cobras which had been sent to him from the brushwood, and by inoculation of fractional and increasing doses into horses he prepared the anti-venom serum which has since then saved so many human lives. He next turned his attention to local economic subjects: he studied the alcoholic fermentation of rice, and discovered a small mushroom, the *Amylomyces rouxii*, which possesses the curious property of transforming starch into sugar and alcohol. The industrial employment of this organism has been generalised not only in the extreme East, but also in European countries: it permits distillers to realise great economies and to obtain such results as cannot be obtained by barley, malt or acids.

In 1895, Calmette, in recognition of his fine work, was appointed by Pasteur and Roux as director of the new institute created in Lille by public subscription, to assure to the population of the North the benefits of vaccination and serotherapy. He created separate services for the application of bacteriological science to veterinary medicine, agriculture and industry in general, beginning with the utilisation of the amylomyces. The Lille Pasteur Institute, under the direction of its founder, assisted by the collaborators he had selected, *viz.*, Guerin, Marmier, Breton, Massol, Grysez and Rolants, became a marvellous instrument of scientific and social action. At the same time that he achieved the work on anti-venom serum, Yersin and Barrel prepared the anti-plague serum (1893–1894).

Three principal problems for the people of the North engaged his attention: the purification of waste water from factories, ankylostomiasis and tuberculosis. It is well known that the waste water from the factories of the North are a very important cause of pollution of the rivers into which they discharge, and cause grave danger to public health. Calmette and his collaborators demonstrated practically by means of a model installation at the Madeleine, near to Lille, that purification of the waste waters could be effected by means of bacterial beds (septic tank system). The waste water thus purified could be discharged without danger into the water courses anywhere.

The solution of the problem of ankylostomiasis had even a greater importance to miners; this affliction is caused by a worm which gains entrance to the intestines of men, where it secretes a very active toxin which causes anæmia and cachexia in its host. It causes great ravages amongst miners in the damp galleries where they work, and where the worm finds conditions favourable to its development and propagation. Calmette made a biologic study of the evolution of the parasite: the worm deposits eggs in the intestines of its host, and these are excreted in the fæces. It was indispensable in order to prevent the spread of the disease from miner to miner to examine the stools of them by aid of the microscope, and to prevent infected miners to work in the mines until they were free from the parasite.

In order to carry out his ideas of preventing and treating tuberculosis, Calmette began the hygienic education of the people, and to assist the numerous afflicted in their homes who could not be admitted into the sanitoria to be cured; he therefore created for this purpose at Lille the first anti-tuberculous dispensary under the name of the "Emile Roux Anti-tuberculosis Dispensary."

Immediately after he arrived at Lille he set out with his collaborators, Guerin, Massol and Breton, to study the infection produced by Koch's bacilli in all its aspects—mode of infection, diagnosis and preventive vaccination. When the greater part of the pathologists were of the opinion that tuberculosis was almost exclusively contracted by respiration, Calmette established experimentally that the bacilli gained entrance specially through the digestive tract. They began to carry out experiments by

XUM

vaccination on bovines, but the War and the invasion of Lille interrupted their research work. During four years Calmette remained at his post endeavouring to alleviate the misery of the population, and to sustain the morale of those around him. It was during this period that he edited his book on " Bacillary Infection and Tuberculosis," an enormous work bringing up to date all that had been done on this subject. At the end of the War he rejoined the Pasteur Institute in the post of sub-director, to which he had been appointed in 1917, and again took up his research work on the B.C.G. (*Bacilli Calmette-Guerin*).

The studies which he pursued with Boquet and Negre showed the complete innocuity of the B.C.G. for laboratory small animals, and the resistance to test infections. He established with Guerin the same effect on bovines, and with Wilbert in monkeys, at the Pasteur Institute of Kindia, which he had created for the study of infectious diseases on anthropoid monkeys.* From then, experiments or tests of vaccination in children could be undertaken. They were at first conducted on 321 newly-born infants that Weil-Hall and Turpin vaccinated by the digestive tract from 1921 to 1924. Calmette chose this method of the introduction of the bacilli vaccine into the organism because of the permeability of intestinal mucous membrane in the first days of life, and the simplicity of administration. The first results observed were so encouraging that, beginning in July, 1924, the Pasteur Institute placed at the disposition of all doctors and midwives who applied for them, doses of the vaccine B.C.G. Up to the present nearly 650,000 children have been vaccinated in France, and about the same number throughout other parts of the world. According to the inquiry effected by Calmette in 1928 on the children followed through the dispensaries and in consequent places all under the same conditions, the mortality due to tuberculosis was 15.9 per cent. amongst the non-vaccinated, and reduced to 3.4 per cent. amongst the vaccinated.

In New York, William Park has vaccinated children born of tuberculous mothers in the hospitals, and has conserved as controls an equal number of children born under the same conditions of tuberculous mothers and non-vaccinated. In children under one year the mortality has been 8 per cent. in the non-vaccinated, and 0.9 per cent. in the vaccinated; from one to two years, 3.8 per cent. in the non-vaccinated and none in the vaccinated.

Cantacuzene, who has organised the vaccination by the B.C.G. in Roumania on a grand scale, since 95 per cent. of the children born in this country are protected by this method, has shown that the mortality by tuberculosis of children in tubercular contact is reduced to 1.3 per cent. amongst the vaccinated, while it is 25 per cent. amongst the non-vaccinated.

If the new ideas do not change our conceptions on the rarity of the hereditary transmission of tuberculosis by reason of the low virulence of the filtrable elements which are in the greatest number of cases eliminated by the newly born, they upset less our ideas on the pathology of tuberculosis.

* Calmette had also presided at the opening of the Pasteur Institute in Algeria before the War, and the Pasteur Institute in Athens after the War.

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